# European standards for mobile communications: the tense relationship between standards and intellectual property rights

Rudi Bekkers, Isabelle Liotard

# European Standards for Mobile Communications: The Tense Relationship between Standards and Intellectual Property Rights

RUDI BEKKERS AND ISABELLE LIOTARD

*Rudi Bekkers, Law and Technology, Eindhoven University of Technology; Isabelle Liotard, Centre de Recherche en Economie Industrielle, Université Paris 13*

This article starts by discussing the nature of European formal telecommunications standards. A new classification of the different types of standards is proposed, and the institutional framework for formal standards in Europe is described. The next section deals with the relevant property rights. The authors distinguish firm strategies for three different phases in the standardisation process. The next section explains how the institutional field reacted to possible problems of intellectual property rights ("IPRs") within telecommunication standards. The subjects of the two final sections, firm strategy and the standardisation bodies' policy, are illustrated in the GSM[1] case. The article then ends with a discussion and conclusions.

## European Telecommunication Standards: Institutional Aspects and a Standards Classification

For the last few decades, the need for standardisation in the telecommunications sector has been growing. Having been witness to radical change, this sector had to re-shape its standardisation structure, a process that is still ongoing. The changes in this sector are caused by both regulatory and technological aspects.[2] The regulatory developments in Europe were led by the European Community. They call for market openness and sector deregulation. First implemented in the United States, a widespread international trend has developed to break up national monopolies. The most important technological development was the transition from an analogue paradigm to a digital one.[3] This change in technology during the late 1980s led to a major restructuring in the telecommunications manufacturing industry, including important concentrations, acquisitions and co-operations.[4]

As a result of these changes in market structure and technology paradigm, the need for changes in telecom standardisation grew as well. Before the 1980s, the standardisation needs of national network operators only concerned cross-border communication, and were fulfilled by international bodies such as the world-wide CCITT[5] and the CEPT[6] in Europe. These bodies, in practice, were made up of representatives of the national network operators, the PTTs.[7] The standards created here were ex-post, reactive to industry needs, and often the result of (regional) compromises. Differing regional views sometimes even led to dual standards, the best example being the two different CCITT standards for digital trunk transmission, which are the basic building blocks on which transmission in telephone networks is based.[8]

During the 1980s, the structure of standardisation adapted itself under the above-mentioned changes in regulatory and technological aspects. The standardisation bodies had to become more pro-active,[9] offering solutions to needs in the telecommunication sector and upcoming new markets. To meet those needs (new) standardisation bodies were created at the regional level: the T1[10] committee in the United States in 1984;

*This article is the result of two ongoing research projects on mobile telecommunication standards. One of these projects has resulted in a dissertation in January 1999. In addition to the literature, this study is based on a number of interviews with participants in the ETSI and the GSM MoU. However, any omissions and errors are the authors'.*

1 GSM: global system for Mobile communications.

2 See G. Dang-N'Guyen, "European R&D policy for telecommunications" (1989) 49 W.I.K. and G. Dang-N'Guyen and D. Phan, "Apprentissages et diffusion du paradigme numérique dans les technologies de l'information et de la communication", in Guilhon, *et al.*, *Economie de la connaissance et organisations*, (1997).

3 See G. Dosi, "Sources, procedures and microeconomic effects of innovation" (1988) 26 *Journal of Economic Literature* 1120–1171.

4 Some major events were the creation of the "new" Alcatel company that included the numerous international ITT subsidiaries, the introduction of AT&T as an equipment supplier on the international market and its co-operation with the Philips company. For further reading on restructuring in the telecommunications equipment manufacturing industry, see Barbara Jenkins, "Strategic partnerships in telecommunications: The role of states in determining comparative advantage," in Lynn Krieger Mytelka (ed.), *Strategic partnerships: States, firms and international competitions*, (1991) pp. 167–181.

5 CCITT: Consultative Committee on International Telegraph and Telephone, body within the International Telecommunications Union ("ITU"), now replaced by ITU-T(elecommunications).

6 CEPT: Conférence Européenne des Télécommunication et des Postes.

7 The term PTT (Post, Telegraph and Telephone) is used here for the traditional national network operator that is controlled by the government. When regulatory functions are split up they are also referred to as public telecommunications operators ("PTOs").

8 After a long and laborious standardisation process, two different standards for the same application were produced. The European flavour, E1, multiplexes 32 channels on a 2 Mbit/s line, whereas the North American/Japanese T1 flavour uses a 24-channel multiplex on a 1.5 Mbit/s line. These parallel standards are sometimes described as a semi-failure on the part of the CCITT (Robert J. Chapuis and Amos E. Joel, Jr., "*100 years of telephone switching*", *Studies in telecommunications*, vol. 13 (1990), p. 299).

9 See, among others, R. Hawkins, *et al.* (ed.), *Standards, innovation and competitiveness: the politics and economics of standards in natural and technical environments* (1995).

10 ANSI: Accredited Standards Committee for Telecommunications—One.

TTC[11] in Japan and in 1987 the European ETSI.[12] The internal organisation of these committees was designed to speed up the delivery of standards, and to support anticipatory (or ex-ante) standards,[13] and meta-standards.

## European telecommunications standardisation before the ETSI

In contrast to many other sectors that became a direct subject of study after the foundation of the European Community (E.C.), it was not until the late 1970s before the Commission turned its attention to this sector. Some main reasons for the growing awareness in Europe for this sector were the failure of the European Unidata computer project,[14] the debates on the information sector taking place in the United States, the American leadership in electronics, and fear of Japanese competition.[15] The first steps of the E.C. date from 1978, when it charged a work group to analyse the telecommunications sector, resulting in a report one year later that advocated harmonisation measures.[16] From this moment on, one can distinguish two different periods: during 1983 to 1986 the E.C. built the main principles of its future telecommunications policy, with the help of various expert groups,[17] and finally laid down its Green Book on telecommunication in 1987. During the second period, from 1987 on, the E.C. implemented these principles in the Community step by step.

The E.C. policy is one of a parallel path of liberalisation and harmonisation. There is a high level of interaction—and interdependence—between these two approaches; harmonisation can be considered a necessary condition to achieve true liberalisation and the breakdown of (technical) trade barriers. One aspect of harmonisation is technical harmonisation, to be achieved by European telecommunication standards. At the time the Green Book was published, the only European body that produced telecommunications (and postal) standards was the CEPT, created in 1959. Its members were PTTs from a large number of European countries (referred to as "administrations" by CEPT), which felt a need not only for technical standards but also for agreements on commercial operations, tariffs, etc. These government-controlled members were usually network operator and regulator at the same time, and in addition many of them controlled type approval, spectrum regulation and the supply of customer equipment as well. When some countries started to divide the functions of network operations and regulatory functions, the operators (then usually referred to as PTOs[18]) still were state-controlled, virtual monopolies.[19] In order to be able to use CEPT standards for their harmonisation measures, the E.C. asked the CEPT, back in 1975, to ensure a number of principles in its standardisation process, such as market co-ordination.[20] However, it is argued that the CEPT members were reluctant to meet these requests because such harmonisation attempts conflicted with their national sovereign powers.[21] Moreover, the CEPT did not have the power to enforce its standards. Although an agreement was reached between the E.C. and the CEPT in 1984 to develop European standards for a number of applications (including teletex, telecopy, videotext and mobile telephony), the two organisations suffered more and more conflicts.

At that time, the E.C. decided on the so-called "New Approach" to standardisation.[22] It did so because the speed (or, better, lack of speed) of the then existing standardisation processes endangered timely European harmonisation through standards. Producing standards often took so long that "[many of them . . . ] were already out of date once agreement on them could be reached".[23] The New Approach, which was adopted by the Council of the E.C. in May 1985, was also deemed necessary to overcome a number of other disadvantages of the standardisation processes used up to then:

- the need for unanimity;
- the failure to develop a link between harmonisation of technical regulations on the one hand, and European standardisation on the other, resulting in wasteful duplications of effort;
- the neglecting of problems concerning certification and testing.

11 Telecommunications Technology Committee.

12 ETSI: European Telecommunications Standards Institute.

13 Anticipatory standards anticipate future needs. They resolve some of the problems that are connected with the long standard production time with ex-post standards. The aim of such standards is to prevent incompatible solutions in the market-place, thus avoiding the creation of a large installed, base-specific assets and sunk cost spending, implying inertia effects to change. For these standards see D. Foray, "Coalitions and committees: How users get involved in information technology (IT) standardisation", in Hawkins, n. 9 above, and P. David, and M. Shurmer, "Formal standards-setting for global telecommunications and information services" (1996) 20/10 *Telecommunications Policy* 789–815.

14 In the Unidata project during the early 1970s, Philips, Siemens, and the French CII company tried to develop an alternative for the dominant IBM computer products. It collapsed in May 1975 when the French Minister of Industry decided to pull out of the project. (Marcel Metze, *Kortsluiting: Hoe Philips zijn talenten verspilde*, (1991), pp. 73–86), and E. Noam, *Telecommunications in Europe*, (1992), p. 75.

15 K. Schneider, *et al.*, "Corporate actor networks in European policy-making: Harmonising telecommunications policy" (1994) 32/4 *Journal of Common Market Studies*, 473–498.

16 Carpentier, *et al.*, *Les télécoms en liberté surveillée*, (1991).

17 Such as the Task Force for Information Technology and Information and the Senior Officials Group for Telecommunications ("SOGT").

18 PTO: Public Telecommunications Operator.

19 Noam, n. 14 above, p. 23.

20 R. Hawkins, "The doctrine of regionalism: A new dimension for international standardisation in telecommunications" (May/June 1992) *Telecommunications Policy*, 339–353. and W. Drake, "The transformation of international telecommunications standardisation: European and global dimensions", in C. Steinfield, *et al.*, *Telecommunications in transition: Policies, services and technologies in the European Community*, (1994).

21 G. Wallenstein, *Setting global telecommunications standards*, (1990).

22 On the New Approach, see Council Recommendation 84/549 of November 12, 1984 concerning the implementation of harmonisation in the field of telecommunications [1984] O.J. L298/49.

23 K. Schreiber, "The new approach to technical harmonisation and standards", in L. Hurwitz and L. C. Lequesne, *The state of the European Community: Policies, institutions and debates in the transition years*, (1991), p. 99.

In order to be able to understand the consequences of this New Approach to the telecommunications sector and its standardisation bodies, this article will now briefly discuss its main characteristics. In the New Approach, two different levels of standards are distinguished. The so-called essential requirements are standards that must be adhered to. They concern areas such as health, safety, the environment and general interests. These standards are laid down as directives based on Article 100 of the Treaty of Rome. The well-known CE mark essentially is a statement by a producer that a product complies with the essential requirements. For particular products, as in the case for terminal equipment in the telecommunications sector, there can be additional essential requirements such as network integrity and interoperability. These requirements have a high priority in E.U. law.[24] The second level of standards is the voluntary standards, or technical specifications, providing Europe with effective standards and associated advantages. A product based on these standards is "automatically" assumed to comply with the essential requirements, while producers of products that are not based on these voluntary standards can be asked to prove conformity to essential requirements. Later it will be seen that the term "voluntary" suggests more than it means here: these types of standards can very well have a mandatory character because of other European or national regulations, such as specific directives aimed at the telecommunications sector, or procurement procedures.

Standards used for both these levels are usually not produced by the E.C. itself, but are drawn up by private European standardisation bodies that are recognised by the E.C. Thus, it is a system of "references to standards". At the moment these recognised bodies are the CEN, the Cenelec, and the ETSI. The two first bodies, which also existed before the New Approach, have adapted their internal structure to meet the new requirements and focus more on anticipatory standardisation processes such as the E.C. promotes.[25] The structure of the ETSI was adapted to the E.U. requirements from the very start. In order to have a standard produced for a certain harmonisation directive, the E.C. can request one of these recognised standardisation bodies to develop a standard for a specific application. This process is called mandating, but this term can cause quite some confusion since it wrongfully suggests that the standard that results from this process will become mandatory.

Lastly, the New Approach provides arrangements that prevent new (national) trade barriers from arising that could frustrate the common European market. Member States are required to notify all draft mandatory regulations to the E.C. and to other Member States, giving them a three-month right to comment on these regulations or intervene if they fear the emergence of a new trade barrier.

## The creation and functioning of the ETSI

In the Green Book on telecommunications, the Commission already indicated that an independent European standardisation body was needed for telecommunications; one with a fair representation of all relevant actors in this sector. Since the CEPT, with its PTO-only representation, could not fulfil such a function itself, it created a new, independent standardisation body in 1987: the ETSI. From 1988, its functions were clarified and many ongoing CEPT projects and their working groups were transferred to ETSI. The start of this new institute, however, was not without problems. Internally, the PTOs initially wanted the ETSI to be more of a research laboratory that would provide input to their CEPT. Externally, the two other recognised standardisation bodies, CEN and Cenelec, opposed the ETSI.[26]

The membership categories and their representation are shown in Table 1. Full membership, with voting rights, may be obtained by a legal person established in the CEPT.[27] Admission of a member is decided on by the General Assembly (see further on). Authors have commented that, in practice, membership for manufacturers is open to those companies that have extensive research facilities in Europe (thus, the mere existence of a manufacturing plant was not sufficient).[28] Thus country of origin, or ownership, is not the deciding factor, and this is why a number of U.S. companies like Motorola, Hewlett-Packard and IBM have obtained a full membership. For organisations that are not allowed (or do not want) a full membership, there is the Associate Membership, now counting 31 members, mainly from non-CEPT countries. In addition there are 87 observers. Neither associate members nor observers are entitled to vote. Lastly, the Commission of the E.C. and the EFTA have a councillor status.

**Table 1: Membership of the ETSI, at December 31, 1996,**

| Membership categories | Number of members |
|---|---|
| Manufacturers | 223 (53%) |
| Public Network Operators | 68 (16%) |
| Administrations, Administrative Bodies and National Standard Organisations | 43 (10%) |
| Users | 28 (7%) |
| Service Providers, Research Bodies, Consultancy Companies/Partnerships, and others | 56 (13%) |

Source: ETSI annual report, 1996, p. 14.

24 Even the rules on Open Network Provision ("ONP") can be restricted by these essential requirements; see also Jan Smits, "Normalisatie: Recht of techniek?" (inauguration speech), Eindhoven University of Technology, the Netherlands, at 14.

25 For example, CEN has adopted qualified majority voting rules, and now allows EFTA members as well.

26 Drake, n. 20 above, p. 87.

27 In this description reference is made to the structure of the ETSI after it underwent its major reorganisation in 1995.

28 G. A. Garrard, *Cellular communications: Worldwide market development*, (1998), p. 134.

National delegations play an important role in the ETSI. For some decisions, voting is done by these delegations and not by individual members. National delegations bring together the different actors from one country and are usually chaired by the national administration (regulator). Though there is little doubt in which national delegation the different administrations and network operators will be presented, this is not always clear with regard to the manufacturers since they often employ activities in several countries. Moreover, it has already been noted that some manufacturers have their origin outside the CEPT area. Manufacturers often participate in the national delegation of the country in which they have their headquarters or in which substantial R&D and/or manufacturing activities are located (and which delegation normally will take their interest into account because of industry politics). But in some cases, they could choose to participate in a different national delegation if they have the feeling that their interests will be better taken care of.

An important aspect of the ETSI is its voting structure. From its creation, they strove for a system in which the votes of the different actors were well balanced. To avoid long unanimity procedures, the ETSI adopted a voting system on its foundation that requires 71 per cent weighted majority votes. This system is still in use, though some rules concerning *who* is entitled to vote have changed. Initially, all votes were cast by the national delegations and their weight was based on country size.[29] The voting rules have been changed several times, and after its major 1995 reorganisation, the ETSI has two different types of voting structures. Some important decisions, including the elaboration, approval and implementation of European standards and structural changes to the organisation itself, are based on 71 per cent majority weighted voting by national delegations. ETSI keeps a list of the weight of each national vote, where larger countries have heavier votes than smaller ones. Other decisions are based on weighted voting by all full members. For administrations, the weight of their vote is based on the gross domestic product ("GDP") of their country. For any other member, including operators and manufacturers, the weight depends on its class of contribution, which in its turn is based on the telecom-related turnover of the organisation in question.

The ETSI underwent some important changes in structure during 1995. One important aim of the re-organisation is to reduce the target time for standards production. The lead time in particular from internal (technical committee) approval to publication was reduced, from an average of 15 months in 1995 to 9.5 months one year later. The formerly separated General Assembly and Technical Assembly merged into one, new, General Assembly, the highest body in the organisation. Daily management of the institute is now being carried out by a Board, which takes routine decisions. ETSI projects ("EP"), such as GSM (including UMTS), DECT, TETRA, CTM,[30] now focus on market needs instead of merely focusing on one particular technology. Technical committees ("TCs"), in contrast, work on one particular technological area and serve one or more ETSI projects.

The ETSI also developed a new set of deliveries. The European Standard (telecommunication series), abbreviated as EN,[31] replaced the former European Telecommunication Standard ("ETS"). This harmonised the deliveries of CEN, Cenelec and ETSI: all of them can produce EN, which can be used as a basis for European regulation and require the full public inquiry and voting process to be carried out by the national standardisation bodies. In addition, there are the ETSI Standard ("ES") and ETSI Guide ("EG"), which do not require the time-consuming public inquiry and voting process, as well as the ETSI Technical Specifications ("TS") and ETSI Technical Report ("TR") which require only the approval of a technical committee or project group. The ETSI also improved its co-operation with other bodies. It also included the option to certify a standard that is developed externally via the public available specification ("PAS") procedure, though this has not been done yet and one attempt to do so resulted in a clash between the developer of this standard and the ETSI, both accusing each other of not meeting the arrangements.[32]

## Classification of standards

There has always been an interest in standardisation from the scientific community, but this has not led to a universally accepted terminology on its characteristics. The meaning of "open", "proprietary" or "sponsored" standards differs according to the author. And even some other expressions such as *de jure* (meaning it can be enforced by law) are often misused. Here this article will try to contribute by making a fairly simple classification of standards used within Europe and particularly applicable to the telecommunications sector. An overview is given in Figure 1.

Market standards are those drawn up by a firm, or a group of firms. They can be called *de facto* if they are widely adopted among other actors in the sector. The support of one or more firms of this standard has led to the term "sponsored standards". More and more, informal standardisation bodies are used to govern such sponsored standards (like the Internet protocols). The firm that developed the standard in question can have

29 See Stanley M. Besen, "The European Telecommunications Standards Institute: A preliminary analysis" (December 1990) *Telecommunications Policy*, 521–530 for a discussion on the original voting procedures within ETSI and its consequences.

30 UMTS: Universal Mobile Telecommunications System; DECT: Digital Enhanced Cordless Telecommunications (before: Digital European Cordless Telephony); TETRA: Terrestrial Trunked Radio (before: Trans-European Trunked Radio); CTM: Cordless Terminal Mobility.

31 The abbreviation is derived from the Latin/Germanic word "norm".

32 This concerns the Tetrapol standard of Matra, a company that at one time left the ETSI TETRA standardisation process and chose to offer their own technology instead. See R. Bekkers and J. Smits, *Mobile telecommunications: Standards, regulation, and applications*, (1998), pp. 232–234 and the TETRA news and the Tetrapol Flash, published by the TETRA MoU group and the Tetrapol Forum respectively.

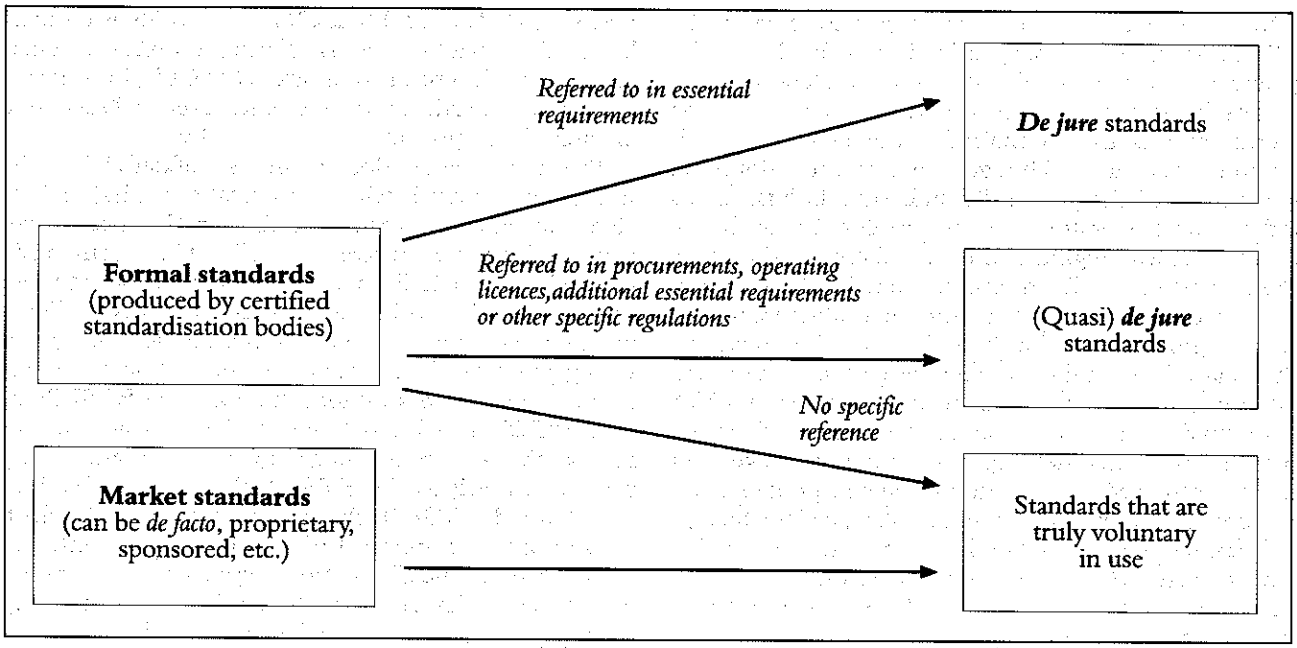


**Figure 1** *Classification of standards*

huge advantages compared to other adopters: installed base effects and adoption increasing return for network industries[33] can contribute towards the firm's market dominance and industry acknowledgement. If the standard in question covers IPRs by the developer, they are proprietary standards.[34] This strengthens the position of the developer because it can influence the behaviour of (potential) adopters. The IPR owner can refuse to license the technology (thereby keeping the market for itself unless others develop alternatives), license it at a relative high cost (restricted proprietary standard), or aim at a wide diffusion by licensing it at low cost.

Formal standards are those drawn up by recognised standardisation bodies. These can be global (ISO, IEC, ITU), regional (CEN, Cenelec and ETSI in Europe), or national standardisation organisations ("NSO"). They can also be called committee standards. In the discussion of the New Approach by the E.C., it was seen that the essential requirements are obligatory. They are law, and therefore can be called *de jure* standards. The voluntary standards within the framework of the New Approach can, in fact, be voluntary. But often they have a more mandatory character than the name suggests. Focusing on telecommunication standards, they can become mandatory because (1) European procurement procedure often forces the use of a European standard; (2) terminal equipment has to comply with extra, sector-specific essential requirements that actually prescribe the standard to be used;[35] or (3) the licence that network operators have received from their government refers to the use of a particular (European) standard such as GSM or DCS–1800.[36] Finally, standards can be (4) referred to in specific (E.U.) regulation making use of the mandatory standard.[37] The authors would like to introduce the term *(quasi) de jure* for this type of standard. One could, of course, consider this mandatory character as a barrier for international trade, and it is imaginable that under pressure of the WTO agreement, Europe might be forced to allow other (non-European) standards to be used as well.[38]

Both standards and IPRs are developed to serve public interests. Standards can overcome many disadvantages related to too wide a variety of products, services or methods, while a framework of property rights is

33 B. Arthur, "Competing technologies: An overview", in Dosi, *et al.*, *Technical change and economic theory*, (1988).

34 A proprietary standard exists "when one or more sponsoring entities holding a direct or indirect proprietary interest—suppliers or users, and private co-operative ventures into which such firms may enter—creates inducements for other firms to adopt particular sets of technical specifications" (P. David and S. Greenstein, "The economics of compatibility standards: An introduction to recent research" (1990) 1/1–2 *Economics of Innovation and New Technology*, 4.

35 In fact, if one wants to use a divergent standard, this standard and/or the behaviour of its equipment will have to be approved by the national standardisation body and the national authorities respectively, for which the standard has to be notified to the E.C. This invokes a "stand-still" procedure in which other administrations can block the approval of the standard in question.

36 However, market reasons (the hyperselective adoption process) or economic reasons can also give a standard a compulsive character.

37 This can be illustrated by the GSM standard. Council Directive 87/372 contains a binding reservation of bandwidth in the 900 MHz band exclusively for the GSM system. There is only a limited number of bands that can be used for mobile telephony according to (binding) ITU regulations, and this Council Directive reserves the (then) most suitable band exclusively the GSM system, leaving little room for other possible systems. In addition, though not binding in nature, Council Recommendation 87/371 co-ordinates the introduction of GSM in all Member States. In practice, these measurements make it impossible to use other standards for mobile telephony in the above-mentioned band.

38 The United States successfully used this argument in 1989 against Japan, arguing that the mandatory use of Japanese standards constituted a trade barrier for the U.S. manufacturer Motorola, finally leading to adoption of the non-Japanese J-TACS standard by two competitors of incumbent operator NTT.

deemed necessary to ensure that individuals or companies can employ innovative activities.[39] However, standards and IPRs can easily conflict because standardisation has a (quasi)[40] public character and strives for equal access for all, whereas property rights are in the private sphere and are meant to give to one party exclusive rights for a pre-defined period. These rights include, *inter alia*, making, selling, using, leasing, importing and repairing the protected object. The owner can choose to license others to perform one of these activities, but is in no way obliged to do so. Also, he can freely choose any licence conditions (such as a royalty fee or an non-monetary consideration), use territorial or other limitations and he is not obliged to treat applicants alike.[41]

## Strategies for Essential Patents and Other Property Rights

The use of IPRs in the telecommunications sector is not new. Actually, IPR was one of the first problems that surfaced when technologies like telegraph and telephony were introduced. In 1837, Cooke and Weathstone were granted a patent on their telegraph system in the United Kingdom. Subsequently, they prevented Morse from obtaining a British patent for his competing systems, despite the technical differences between those two systems.[42] Also the telephony industry was affected by patent disputes. The validity of the original United States telephone patent of Alexander Graham Bell has been subject to more than a hundred assaults. Its most essential claim was hand-written in the margin, and many believe this insert was based on a later patent filing of Bell's rival Gray and added by Bell *after* the original filing.[43] In England, both Alexander Graham Bell and Edison had received telephone patents, but they did not succeed in reaching a co-operation agreement with the British Post Office. Patent problems occurred in many other countries as well. Market shares in the telecommunication equipment market in the first half of this century were often determined by cartel agreements and/or fixed allocations by governments.[44] However, during the major growth and consolidation of the telephone system during the twentieth century, system network monopolies and exclusive national supplies pushed the patent problems into the background. Any risks of infringement of IPRs were removed via clauses in purchase contracts from the network operators to their suppliers, who usually owned most of the IPRs for the technology they used (if any). Now, however, for reasons given below, IPR is again becoming of prime importance in the telecommunications sector.

In the field of the development of recent European telecommunication standards, a number of actors are involved. These actors and the main relations between them are given in Figure 2. The network operators, national governments and manufacturers are members of the ETSI, whereas the European Commission has a counsellor status. The E.U. can mandate the ETSI via its Commission to develop a certain standard, and might use this standard as a basis for regulation. Furthermore, the E.U. regulates industries via general regulation and, more specifically, competition rules. National governments often own the national public network operators and in some countries, such as France, the state owns significant parts of the telecommunications manufacturing industry as well. Governments practise industrial politics in favour of their national industry (and often in favour of foreign industries, too, that have considerable manufacturing facilities in that country). IPR owners can be manufacturers, network operators, and sometimes neither of the above.[45]

There exist a number of different types of IPRs. The ones most relevant to the telecommunications sector are patenting, copyright (notably on software) and rights on semiconductor topographies.[46] The importance of these rights in the field of telecommunications is growing, just as the probability that standard designers cannot work around existing, protected knowledge. This importance is likely to grow even faster in telecommunications than in other areas, for the following reasons:

(1) The more technical a sector, the more patented that sector is likely to be.[47]
(2) Telecommunications industries spend a high share of their turnover on R&D,[48] and the patent intensity of this industry is rising.[49]
(3) The development into a truly open, worldwide market for (standardised) equipment in contrast to the protected, national markets in the past increases the need to protect the results of research efforts.
(4) Telecommunications mainly deals with compatibility standards that require a detailed, conscientious description of all features of the system

39 See J.W. Schlicher, *Licensing intellectual property: legal business, and market dynamics* (1996).
40 The authors call this (quasi) public because in practice not all parties have equal access to the standard and to the standardisation process.
41 The absolute control that an owner has can be limited, however, by laws concerning abuse of dominant positions, such as Art. 86 of the European Treaty; see also the discussion further on.
42 Noam, n. 14 above, pp. 17 and 19.
43 See J. Brooks, *Telephone: The first hundred years*, (1975), in particular pp. 46–48.
44 On patents, licences and cartels in telecommunications history see Noam, n. 14 above, in particular p. 73, and P. Verhoest, *et al.*, *Telecommunicatie en beleid in België* (1991), in particular pp. 83, 91, 97, 154.
45 In the GSM case, for example, Bull is an IPR owner of technology used in the SIM chip card via its CP8 Transac subsidiary. However, Bull is not a manufacturer of GSM infrastructure or terminals.
46 In this text, confidential information, trade secrets or the like are not considered to be an IPR. Although IPR also covers areas such as trade marks, designs, etc, these types of protection are less relevant for this research.
47 D. Good, "1992 and Product Standards: A Conflict with Intellectual Property Rights?" [1991] E.I.P.R. 398 at 401.
48 In 1996, the worldwide top 10 telecommunication companies spent approximately 10 per cent of their turnover on R&D. Based on data of Sirius, Montpellier, quoted in *Communications Week International*, November 24, 1997, p. 31.
49 U. Schmoch and T. Schnöring, "Technological strategies of telecommunications equipment manufacturers: A patent analysis" (1994) 18/5 *Telecommunications Policy*, 397–413.

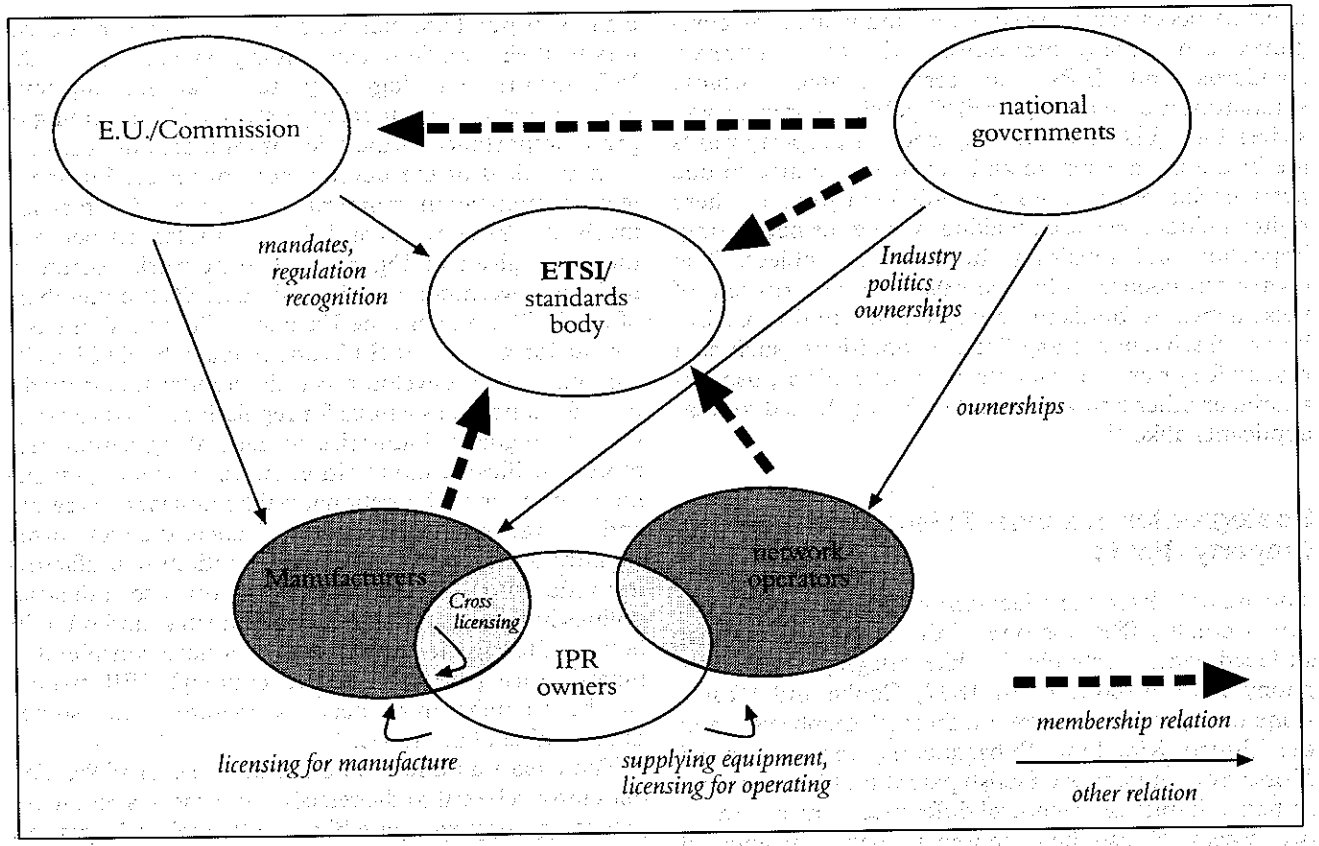


**Figure 2** *Actors and their main relationships*

interfaces[50] involved, raising the chance that standards cover patented technology.

(5) Standardisation bodies are increasingly inviting industry to participate in drawing up standards and sometimes even ask them for complete system proposals.[51] Those industries are likely to come up with technical proposals that are covered by their own IPRs. Ex-post standardising has a similar result.

(6) Digitalisation of telecommunications systems and convergence with the I.T. industry bring other patent areas into the telecommunications field.[52]

(7) Implementation of equipment designs is more and more embodied in integrated circuits and in software, thereby introducing protection rights on semiconductor topographies[53] and copyrights into the telecommunications arena.

When the relation between standards and IPRs is being investigated, the term "essential IPR" for a standard plays a central role. In essence, this term means that on technical (but not commercial) grounds it is not possible to produce, sell, import, use or operate products that conform to a certain standard without infringing that IPR.[54] Standardisation bodies would preferably draw up standards that have no or little essential IPR. But for reasons mentioned above, they do not have much choice. Indeed, ETSI takes the view that having essential patents in their standards is inevitable and unavoidable.[55] It is also possible that a standardisation body is not aware that (part of) the standard they have

50 An interface describes the behaviour between two system components, and compatibility standards basically define the (electrical, logical, or other) behaviour of signals on such an interface.

51 A clear example of the degree of industry participation within telecom standardisation can be found both with GSM and for the recent process of choosing an appropriate air interface for the European third-generation mobile network, UMTS. In both cases, a battle started between different technical proposals put forward by industry. Invested stakes are so high that industry will not support a completely new design and bodies are forced to choose among one of the designs offered by industry.

52 G. Lea and M. Shurmer, "Clash of the Titans? Intellectual property rights and telecoms standards" (1994) 15/3 *Media Law and Practice* 89–93.

53 Such as the protection resulting from the E.C. Semiconductor Topography Directive 87/54 [1987] O.J. L24/37 and in the U.S. Semiconductor Chip Protection Act 1984.

54 The ETSI uses the following definition of essential IPRs in its original IPR Policy and Undertaking: "that it is not possible on technical but not commercial grounds, taking into account normal technical practice and the state of art generally available at the time of standardisation, to make, sell, lease, otherwise dispose of, repair, use or operate equipment or methods which comply with a standard without infringing that IPR" (IPR Policy and Undertaking, at D2). In addition to the definition of the ETSI, the Commission of the E.C. adds *import* to the list of activities (Communication from the Commission on Intellectual Property Rights and Standardisation, COM (92) 445 final, October 27, 1992, further on referred to as "Communication on IPR"). Though these definitions exclude commercial grounds, this must be considered virtually impossible since every technical alternative has to be judged by its commercial consequences and possible other consequences (the need to adopt a completely different technical approach, or need for computer power or energy of a technical design, etc.).

55 R. Tuckett, "ETSI's IPR policy: The implications for companies using European telecoms standards" (September 1993) *Patent World* 23.

drawn up is protected.[56] Essential IPR is most likely to concern patents, although software copyright on an encryption algorithm, for example, can also be an essential IPR. Table 2 lists different types of IPRs that can be found in the telecommunications sector. However, non-essential IPRs can be valuable too: the costs of designing and producing a specific semiconductor chip are so high that many manufacturers opt to buy their chips either from a general supplier or a competitor. Non-essential IPRs can be traded for essential patents via cross-licensing agreements. Finally, non-essential IPRs can represent value if alternatives are—strictly speaking—technically possible but are less preferred, more costly to realise, or have other disadvantages.[57]

**Table 2: Types of IPRs in telecommunication systems**

| Type of IPR | Remarks | Usual licence types |
|---|---|---|
| Essential patents | Necessary to produce any product that meets the relevant interfaces that are defined in the standard. It can cover either general system architecture or specific details. | Manufacturers of infrastructure and terminals pay a fee to the licenser. Some owners agree on cross-licensing. Network operators usually defer any IPR infringement responsibility to their supplier via clauses in the purchase contract. |
| Non-essential patents | Useful but not necessary to produce products that meets the standard, for example concerning the implementation of the standard into electrical circuits. | Manufacturers of infrastructure and terminals that implement that particular patent pay a fee to the licencer. Some owners agree on cross-licensing. |
| Copyright on software (non-essential, apart from some rare exceptions) | Protection of computer programs in programmable hardware (such as switches in the infrastructure) or in embedded electronic systems (such as handset controllers in a mobile phone). | In the case of infrastructure, a network operator pays a one-time or yearly user licence fee to the licenser (usually the supplier). Often this fee is dependent on actual network size.[58] In the case of embedded software in terminals the licence costs are included in the retail price. |
| Rights on semiconductor topographies[59] non-essential | Concerns the design of semiconductor devices | Price is included in the price of the semiconductor device bought by the producers. |

## Strategies of IPR owners

Owners of IPRs are likely to pursue an optimum licence strategy, *i.e.* the most profitable strategy. Grindley[60] recently performed a number of case studies on standard strategies, including IPR licensing aspects. His cases are mainly concerned with industry standards that allow for voluntary adoption, that are developed outside the official standardisation bodies, with little interaction of policy and regulation.[61] He argues that the main objectives of a strategy are (1) creating a common, widely adopted standard[62]; (2) maximising returns for the individual firm; and (3) competing effectively once standards are established. Although the second (and third) goal would benefit from high licence fees, the first goal forces the IPR owner to ask only modest fees and generally will lead to non-discriminatory and fair licensing conditions. Additionally, the first goal requires critical timing.[63] It has been seen that European telecommunication standards have a mandatory character. The authors' research shows that, in the case of compulsory standards, the optimum strategy can differ from the ones listed above. Ownership of an essential IPR for such a standard is of even greater value to its owner. Some of these optimum strategies can interfere with the objectives of a common standard (especially if they have a compulsory character) that asks for non-discriminatory, fair and reasonable access to the standard for all the parties that would like to adopt it.

Here this article will distinguish between three different phases that each have their accompanying strategies. In ex-ante standardisation processes, as found in formal European telecommunications standards, there is the pre-standard discussion phase, where a small number of actors discusses the need for a standard and work on technology options; the standard production phase (when the main technological characteristics are chosen and the standard itself is being drawn up); and the standard diffusion phase, when manufacturers are implementing the standard for commercial products.

56 Patent searches are a costly matter. Because of the number of existing patents, the separate national patent protection systems and the character of patent texts, it can be difficult to determine whether a standard infringes an existing IPR in a certain geographical area.

57 For example, if one considers a software algorithm that is necessary in a mobile terminal, the need for processing power and/or the energy consumption of one implementation can be strongly preferable to its alternatives, even though this does not make the first algorithm an essential IPR.

58 In the case of GSM, some suppliers base the yearly fee of the (software) licence of use on the actual number of base station circuits present in the network.

59 See n. 53 above.

60 P. Grindley, *Standards, strategy and policy: Cases and stories* (1995).

61 Exceptions are the cases on Telepoint cordless telephones and on high-definition television, where a certain level of interaction with policy and regulation was present.

62 Grindley notes that the market tends to be "hyperselective", that is when the standard which reaches a critical number of adopters first (increasing network externality effects), this standard will start to dominate the market while other, alternative standards have little chance of gaining ground.

63 M. Katz and C. Shapiro (1985) "Network externalities, competition and compatibility", *American Economic Review*, No. 3, June, pp. 424–440; M. Katz and C. Shapiro (1986) "Technology adoption in the presence of network externalities", *Journal of Political Economy*, Vol. 4, No. 4, pp. 822–841, Katz and Shapiro show how sponsoring initial adopters can favourably influence timing.

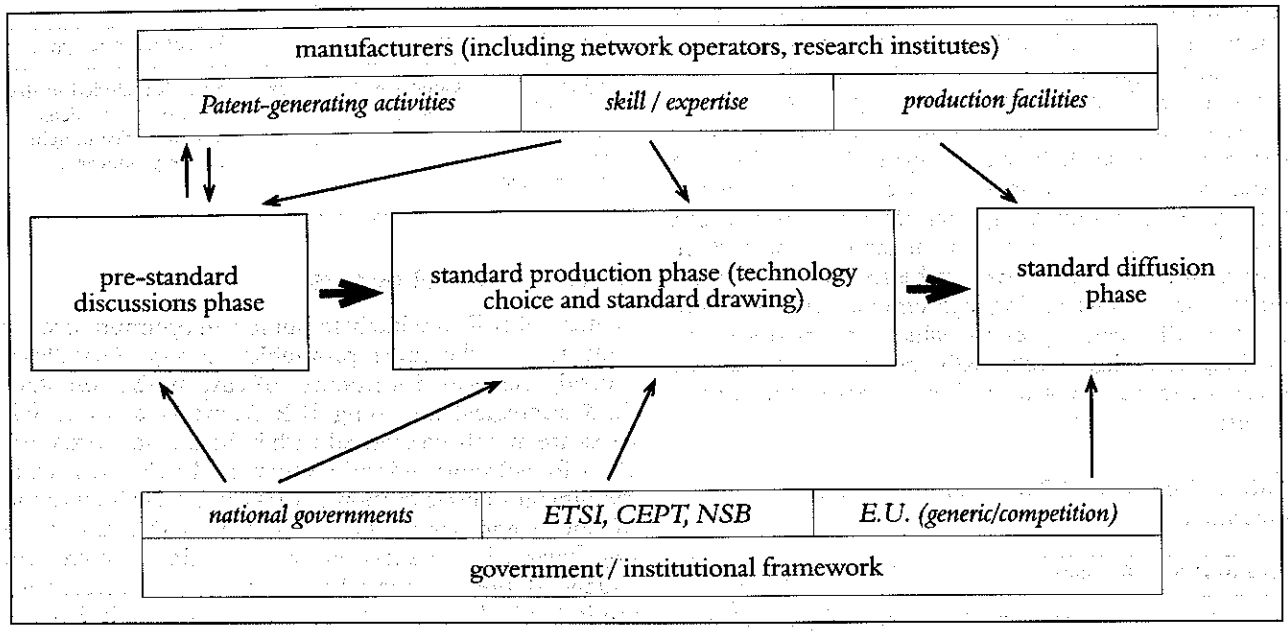


**Figure 3** *Standardisation phases*

Figure 3 shows these phases and the nature of the involvement by the actors.

During the pre-standard discussion phase, manufacturers go through the different technology options. Sometimes national governments and/or the E.U. are involved in stimulating their national manufacturers to develop suitable technologies; which can be accompanied by appropriate subsidies both on the national and European level. During this phase, manufacturers will intensify their research activities that anticipate the standard in order to find patentable or protectable inventions. Relevant strategies for (potential) IPR owners during this phase are:

(1) *General architecture patenting strategy*: concentrating on patentable knowledge concerning the system architecture of the standard in question. Architectural designs are more difficult to by-pass than specific technologies.
(2) *Minefield patenting strategy*: trying to patent many smaller technological designs in order to prevent by-passing.
(3) *Trade secret strategy*: intensifying research activities that anticipate the standard, but keeping the knowledge and skills for themselves.
(4) *Misleading applications strategy*: patenting *and publishing* certain (smaller) inventions that might put competitors on the wrong track concerning one's technology preference, while patenting other technologies at the same time but using the available rules for delaying their publication. In fact, this is a non-disclosure of technical interests.

During the standard production phase one must, of course, try to ensure that a certain IPR is going to be incorporated in the standard in question. Achieving this goal might be done in different ways, depending among other things on the rules and practices of the standardisation body in question. In any case, active participation in the standardisation programme may increase a firm's chances, as well as achieving back-up from its national delegation in the standardisation body and back-up from other manufacturers. From the perspective of a firm that owns IPR that could potentially become essential for a standard, the authors' research shows that there are a number of possible strategies:

(1) *Licence with general declaration strategy*: announcing the ownership of the potential essential IPR and declaring that licences will be available on fair, reasonable and non-discriminatory terms. This is the most usual strategy to have a proprietary technology adopted as (part of) a standard.
(2) *Licence without general declaration strategy*: announcing the ownership of the potential essential IPR but making no declaration on licence conditions.[64]
(3) *Withholding strategy*: choosing not to license the IPR in question but deploying it for other standards or systems instead. This can be a relevant strategy where several standards or technologies compete on the market.
(4) *Non-disclosure or late disclosure strategy*: not informing other parties of the existence of the IPR. (In most European patent application procedures, the detailed content of a patent application is not accessible in an 18–month initial period; in the United States a forthcoming patent can be kept secret for much longer).[65]

64 For example the Motorola strategy in the GSM case; see further on.

65 An example is the strategy that the U.S. computer manufacturer Dell used concerning the VL-bus (or VESA Local Bus) architecture found in PCs. When the standard was drawn up by the Video Electronics Standards Association ("VESA"), Dell declared on being asked that it owned no IPRs on this technology. However, once the VL-Bus was approved and diffused in the market, Dell informed VESA members that the technology infringed a Dell patent. FTC was asked to settle the issue and finally ruled that Dell's behaviour was antitrust and that (1) it was not allowed to enforce the patent rights in question for 10 years and (2) it has to follow the procedures when participating in standardisation processes.

In addition to the IPR strategies mentioned above, an IPR owner might opt to go into a co-operation agreement with another actor to create better support for its technology via an exchange of technology, knowledge, IPR, or skills for example.

During the standard diffusion phase, the firms that did achieve essential IPRs for a standard can again opt for a number of different strategies, on the condition that they did not commit themselves to certain agreements beforehand. In general, firms will offer other parties the use of the IPR under certain conditions, in return for a licence fee. The calculation base of this fee can be unit volume, turnover volume, usage, or a fixed price. The possible candidates for licences not only include other manufacturers of equipment that adhere to the standard in question, but can also include parties that sell, lease, repair, use or operate equipment or methods that are covered by an IPR, whether essential to the standard or not. In the practice of telecommunication standards, this means that owners of essential IPRs can require all manufacturers and all the network operators to have to license that IPR from them. In addition, an owner of a non-essential IPR—employed in their own products—can ask a user licence fee from the network operator that bought these products. For example, in the case of operating software, the supplier demands from its infrastructure customers (*i.e.* network operators) a one-time or a yearly fee for using the software installed on this infrastructure. It can also demand additional user licence fees for the regular updates or new additions to operating software. This creates a strong lock-in situation for the network operators, since replacement of (parts of their) infrastructure invokes high switching costs. Some strategies and issues for the licenser include:

(1) *Demanding non-financial considerations* in return for licences, for example cross-licensing for other IPRs. These may involve essential and non-essential patents. Cross-licensing can give a company access to other technologies that complement its own, and that would otherwise be impossible or costly to obtain. If contributions from both (or more) parties cover the same standard, a patent pool can be created, resulting in lower access costs compared to third parties.
(2) *Non-disclosure*: first waiting for other firms to bring products to the market, and afterwards claiming infringements of an IPR.
(3) *Delaying applications* for licences, thereby making it more difficult for competitors entering the market.
(4) *Constructing discriminatory conditions* for applicants. An IPR owner could decide to negotiate each application individually, or demand divergent terms for applications from different world regions. In practice, competition can thus be limited to a restricted number of participants.[66]
(5) *Refusing to make licences available* to all or certain applicants, or demanding prohibitively expensive licence considerations on a take-it-or-leave-it basis.[67] This is an option if the owner prefers to support an alternative standard or for some reason would like to block the standard.

Licensing agreements are usually treated as highly confidential, making it difficult to study the situation for specific standards or sectors. Apart from these individual firms' strategies, one must also take the cumulative effect into account.[68] That is, if a large number of IPRs are involved in one standard, the sum of all licence fees could be large even if each separate licence fee is reasonably—or even modestly—priced. In such a case, even the most efficiently run business would be prevented from operating profitably under the standard. With complex compatibility standards the chances are high that a large number of IPRs are involved, particularly in the case that the standard involves more than one interface.[69] For example, with respect to the GSM standard, in total 132 essential IPRs are claimed by their respective owners.[70] Further on, it will be seen that for GSM the cumulative fee of licences became the largest single cost for producers.

## The Institutional Framework for Telecom Standardisation and its IPR Policies

### Policy of the traditional standardisation bodies towards IPRs within standards

Standardisation bodies have always been aware of the tense relationship between standards and IPRs. However, in the past, bodies like ISO/IEC, CEN/Cenelec have been able to function with property rights arrangements on a voluntary basis. These bodies apply a common policy:

> [Known owners of IPR for a draft standard] are asked whether they would be willing to negotiate licences . . . with applicants throughout the world on reasonable terms and conditions. A record of the patent holder's statement . . . shall be referred to in the relevant International Standard. If the patent holder does not provide

66 It is believed that during the first years Japanese manufacturers were not given access to essential IPRs for the GSM standard and therefore could not compete in this sector (see further on).

67 See the example for GSM given in G. A. Garrard, *Cellular communications: Worldwide market development*, (1998), p. 140, who notes that "Although the commercial licensing conditions for GSM patents being offered to non-European manufacturers are highly confidential it is widely believed that hey are prohibitively expensive and offered on a take-it-leave-it basis." See also I. Liotard, *Normalisation, droits de propriété intellectuelle et stratégies des firmes*, (1999), PhD Dissertation, CREI, University of Paris 13.

68 Tuckett, n. 55 above, at 27.

69 Mobile communication standards often define several interfaces (air interface, interface between switching components, etc.).

70 *ETSI Technical Report* 314, a publication by the European Telecommunications Standards Institute (ETSI), Sofia Antipolis, France, July 1996. Figures are based on a list of firms' notifications to the ETSI. This list does not guarantee that no other essential IPR exists, nor that the listed IPRs are in fact essential. Some notifications concern wide geographical protection while others are limited to one country, possibly creating overlap within the list.

such a statement, the Technical Committee shall not proceed with the inclusion of the patented item unless the respective Council gives permission.[71]

The other important standardisation body in telecommunications field, the CCITT,[72] employs a "code of practice" where the detailed arrangements are left to the parties involved, as these arrangements differ from case to case.[73]

In general, it has always been considered "normal practice" for IPR owners to make licences available on fair, reasonable and non-discriminatory terms, even though there is no way to enforce a recalcitrant owner to do so.[74] The ETSI was unique in the sense that it was the first (and still the only) body that tried to adopt an alternative policy concerning those rights. ETSI's intended measures invoked a lot of resistance, clearly illustrating the interests of the parties involved, and so this article will now provide more details about this case. Although the general discussion on property rights within ETSI does not revolve around GSM, one must know that this standard is the most important outcome of the ETSI to date. Therefore, events concerning GSM patents coincide several times with the more general ETSI measures.

## Policy of the CEPT and the ETSI towards property rights within standards

The ETSI policy had its prologue back in the CEPT period when the work on the GSM standard commenced, in 1982. Simultaneously with putting together a technical committee to investigate the standard, the CEPT announced that it would be mandatory for any company having patents essential to the standard to provide free licences under those patents.[75] Again, one must bear in mind here that the CEPT members were mainly IPR users, not IPR creators.[76] Although the CEPT had no means of enforcing such measures to patent owners, its members (European PTTs) declared that if an owner did not give free licences he would not be entitled to bid on any contracts for the supply of digital cellular equipment to members. Thus IPR owners could simply be forced to give away the results of their research efforts without compensation simply because their technology was selected for a CEPT-standard. This announcement caused quiet outrage among European manufacturers. After an American company with European operations objected to this negation of patent rights, the CEPT members decided to revoke their claim.[77] Thus the conflict was resolved, and in the years that followed the general scepticism of the manufacturers slowly gave way to enthusiasm when the size of the market became clear. Manufacturers actively joined the GSM development within CEPT.

When the CEPT initiated the establishment of the ETSI, it was given a commission to develop clear conditions for the inclusion of property rights within its standards.[78] The starting-point was that public interests and the interests of IPR owners had to be well balanced. Some early drafts, however, were unfavourable for IPR owners[79] and attracted the attention of the Commission of the E.C. which emphasised that property rights had to be properly respected.[80] In particular, the Commission concluded that compulsory licensing could have a short-term advantage for the user, but in the longer term research investments would dry up, and non-Community entities with extensive research activities would be encouraged to keep their technology out of E.C. markets. At the same time, low-cost manufacturing centres outside the E.C. would benefit from cheap licensing.[81]

Within this field of strongly varying interests of network operators, manufacturers, E.C. and other parties, the discussions on the IPR framework lasted for over three years. In March 1993, the ETSI put their so-called IPR Policy and Undertaking forward for voting at its General Assembly, to be voted on by national

71 Reference to patented items IEC/ISO directives—part 2: Methodology for the development of international standards," quoted in Communication on IPR, at Annex A, subsection B, (n. 54 above, p. 5).

72 After the ITU's reorganisation replaced by ITU-T.

73 CCITT patent policy, Annex 5, quoted in Communication on IPR, at Annex A, subsection B, (n. 54 above, p. 5).

74 See n. 2 above.

75 See S. L. Wilkinson, "They're stealing our diamonds: the standards assault on patents", (1991) 8/2 *Canadian Intellectual Property Review* 193 at 197; Good, n. 47 above, at 402. Some respondents note that this was more the action of some particular CEPT members such as Italy, and that within the CEPT group there was no general consensus that this would be the best way to deal with IPR questions.

76 IPR stems mainly from R&D work. Often national governments and—now—the E.U. grant significant subsidies for research in this area. It is true that most TNOs have large research centres at their disposal (the CNET laboratories of France Telecom, for instance). But in recent years fundamental R&D intensity for TNOs has decreased a lot, making room for more applied research that has less potential to generate essential IPR for standards. More fundamental research—potentially generating IPRs—is being done by manufacturers.

77 Wilkinson, n. 75 above.

78 Some authors argue that ETSI felt forced to develop an IPR policy when, during the early 1990s, it became clear that Motorola refused to give licences on essential GSM patents, making grants only through cross-licence agreements (Hansen and Søndergaård, "Does GSM make sense? An assessment of GSM as an example of Paneuropean technology development" paper to the European Conference of International Telecommunications Society, Götenborg, Sweden, June 20–22, 1993, p. 7; also Cattaneo, "The making of a pan-European network as a path-dependency process" in G. Pogorel, *Global Telecommunications Strategies* (1994), p. 64, mentions Motorola's demanding licence conditions.) Earlier attempts, in 1988, of the group enacting the GSM MoU to secure fair and equal sharing of royalties for essential GSM patents failed, notably by Motorola's refusal to co-operate (Cattaneo, *ibid.*, pp. 3/64). National operators then had to negotiate individually the provisions concerning IPRs in their contracts for the deployment of national networks; see further on.

79 The earliest draft proposed compulsory licensing (though in return for an equitable remuneration), compulsory "in-house" arbitration and waiving of copyrights in standards. See C. Prins and M. Sliessl, "The New European Telecommunications Standards Institute Policy: Conflicts between Standardisation and Intellectual Property Rights" [1993] E.I.P.R. 263–266; Wilkinson, n. 75 above; and Written Question 2525/92 to the Commission of the European Communities [1993] O.J. C51/26.

80 In its earlier 1990 Green Paper on standardisation (Commission Communication on the development of European Standardisation: Action for faster technological integration in Europe, [1991] O.J. C20/1) the Commission hardly paid any attention to IPR. But in its 1992 Communication on Intellectual Property Rights and Standardisation (n. 54 above) it positioned itself in favour of an adequate protection of IPRs.

81 *ibid.*

delegations. As discussed earlier, these delegations are led by the national regulator that usually takes the interest of both national operator(s) and national industry into account, while non-European (or better: non-CEPT) industries often express their interests to the delegation of the country in which they have their European headquarters. Representatives of these operators and industry often join the national delegation at meetings and sometimes even speak for the delegation. In practice, former telecom administrations have considerable power within national delegations.[82] When the IPR Policy and Undertaking was voted on, the proposal was adopted with 88 per cent positive votes (the minimum is 72 per cent). Italy, France and Germany[83] were the main supporters of this policy. It is best characterised as "licensing-by-default": unless specific actions are taken, an IPR owner automatically agrees to licence on fair, reasonable and non-exclusive conditions. Its main provisions are as follows:

- ETSI members are obliged[84] to sign a so-called Undertaking in which they commit themselves to granting licences of essential IPRs to other ETSI members.[85]
- Licences must be on fair, reasonable and non-exclusive conditions, including a provision that resembles an MFN clause.[86] Licences must be for monetary consideration unless both licensee and licenser agree otherwise. The licenser must inform the ETSI in advance on the maximum royalty fee that will be requested.
- Licences can only be withheld if they are notified to the ETSI within 180 days after the Technical Assembly puts the relevant draft standard in its work programme. If this procedure is not followed correctly, sanctions can be severe since other members are then allowed to refuse or terminate their licences to the party in question, effectively blocking its access to the market.
- The ETSI does not assume any responsibility for patent searches.
- It is an interim policy, to be evaluated and replaced by a definitive policy within four years.

Although this policy tries to do a much better job in balancing the interests of IPR owners and public interest than the earlier drafts, it still provoked strong reactions.[87] Its licensing-by-default system was considered unfavourable for IPR owners, especially because it is so difficult to identify the IPRs that are involved in an early stage. The ETSI has a lot of simultaneous work programmes that each produce considerable if not voluminous amounts of documentation, placing a burden on an IPR owner who has to monitor all of this. Though members are obliged to inform ETSI about any relevant IPRs they are aware of, owned by themselves or any other party, this does not guarantee that IPRs of non-members are indeed identified, with all possible risks. Instead, the ETSI turns the responsibility for IPR searches to the Commission of the E.C., a provision that cannot easily be defended.[88] Furthermore, the ETSI itself must comply with European competition law, and forcing its members to sign the Undertaking could be in breach of Article 86.[89]

Notwithstanding the relevance of the policy itself, some developments make the consequences of this policy even more alarming to some parties. First of all, it has been seen that many ETSI standards have a compulsory character, and access to the standard (and its IPR) is the only means for access to the market, in any sense. Secondly, by means of I.T. and telecom convergence and possible wider adoption of these types of policy, consequences could possibly spread to the I.T. industry. For the United States industry, these measures embodied the fear of "Fortress Europe", as introduced in the 1992 OTA report on Global Standards.[90] The commitments in the Undertaking concerning manufacture, sale or leasing are limited to Europe,[91] while commitments concerning use or operation apply worldwide. This measure is clearly included to stimulate export from Europe towards other areas since it facilitates *use* of standard-compliant products worldwide, whereas it facilitates *manufacturing* of these products only in Europe.

One should also note that in the United States, the Reagan administration emphasised that IPR is a field of particular importance to United States companies, and these companies regarded these rights much more as an asset that could be exploited than their European counterparts. Indeed, it was the United States trade body, the Computer and Business Equipment Manufacturers Association ("CBEMA"), that filed a formal complaint with the E.C. Commission Competition Authorities on June 22, 1993.[92] This voluminous document brings up a number of grounds, predominantly based on an assumed breach of Articles 85 and 86 of the E.C.

82 See Besen (1990), Paffen, T. "The role of strategic standardisation in the context of successful telecom innovators", (1996), in *Proceedings of the Third Annual EURAS conference on Standards and Society*, 3–5 May, Stockholm, and "Complaint and request for interim measures against the European Telecommunication Standards Institute ETSI", submitted by the Computer and Business Equipment Manufacturers Association CBEMA to the Commission of the European Communities.

83 Germany was initially against the measures but turned into a supporter later on.

84 This can be depicted from the wording of the Policy: "Each applicant for membership of ETSI *must* sign the IPR Undertaking. Existing members *shall sign* the Undertaking within 6 months from receipt of a written request from ETSI to sign," (at s. 3.1, *emphasis added*).

85 Plus other legal entities present in the so-called Standards Application Area that also signed an Undertaking.

86 The most-favoured-nation clause, such as used in WTO terminology, determines that any new (more favourable) terms or conditions offered to a party must be offered to all other, existing partners as well. In the ETSI case, one could call this a most-favoured-licensee clause.

87 Both positive and negative reactions have been written by Wilkinson, n. 75 above; Tuckett, n. 55 above; Prins and Schliessl, n. 79 above; and Lea and Shurmer, n. 52 above.

88 Prins and Schliessl, n. 79 above.

89 *ibid.* See also further on.

90 U.S. Congress, Office of Technology Assessment, *Global standards: Building blocks for the future*, TCT-512, Washington, 1992.

91 More specifically, the Standard Application Area that is defined in the Undertaking, comprising all West European countries, most East European countries, and Australia, New Zealand and Israel.

92 CBEMA, see note 82.

Treaty. It particularly asks for an end to the licence-by-default system in ETSI and suspension of further steps that could expel or discriminate ETSI members that object to the policy.[93] In addition, they asked to allow for non-monetary considerations to licensers (particularly cross-licensing). It could be argued that CBEMA members were seeking to make it a political issue, and commentators have criticised some parts of this complaint.[94] However, it did make clear that the policy, which in weighted voting did enjoy the qualified majority, still caused strong rejection within some groups of actors that are represented in ETSI.

Before awaiting the outcome of this complaint, the ETSI decided to abandon its policy, preventing the Commission from ruling on this delicate issue. This was done during the General Assembly ("G.A.") of the ETSI during their meeting on November 22 and 23, 1994, where it was decided to annul the original 1993 policy to achieve a larger consensus among its members. At the same meeting, the G.A. decided for an interim IPR policy that is less far-reaching than the original one.[95] In addition, ETSI dropped plans for changes to their Statutes and Rules of Procedure that made it possible to expel members not signing the Undertaking. The main arrangements of the new policy are:

- Owners of IPRs, members or not, will be rewarded in a suitable and fair manner.
- Members will make a reasonable effort to inform ETSI of IPRs they are aware of. If they propose a technical design to ETSI they will also, in good faith, draw attention to IPRs that could become essential if that proposal is adopted.
- If an essential IPR is identified, the director of the ETSI will request the owner, member or not, to make licences available on fair, reasonable and non-discriminating terms.
- ETSI members can choose not to license an IPR. If no other alternatives exist, the director of the ETSI will request the owner to revise its position. If the member refuses to do so, it will inform the director about its reasons for not doing so; this explanation will be passed on to ETSI's advisors (including the Commission).

It is noted that in the case that licences cannot be obtained, it could eventually result in non-recognition of the standard in question. Since the policy can possibly be explained as an agreement that limits competition, the ETSI sent a notification to the Commission of the E.C. The Commission has been somewhat ambiguous towards this notification: on the one hand it noted in its annual report that it believes the agreement is not in breach of Article 85 of the Treaty, but on the other the Commission has never actually given an official negative clearance and/or an exemption.[96]

## The GSM Case: An Example of IPR Strategies in Real Life

GSM, as the best-known and most successful European telecommunication standard, provides a good opportunity to examine strategic behaviour concerning IPRs in practice. Several of the strategies that were distinguished for the standard production and the standard diffusion phase are used by different IPR owners in the GSM case. Furthermore, GSM was a prime test of a harmonised European standard, and it has already been mentioned that the development of the GSM standard interacted with the development of ETSI's IPR Policy several times. Opportunities and threads of IPR have been high on the agenda of both manufacturers and network operators since the very beginning. It has already been seen that the network operators, back in 1982, made an unsuccessful attempt to ensure free licences to IPRs concerning this standard. Some suppliers feared that drawing up a standard (without protective IPR strategies) would open the market to dangerous Japanese competition.[97] On the other hand, depending on its exact arrangements, a European standard could open a window of opportunity to create a pan-European—or even wider—standard with strong E.C. industry participation, since no competing technologies were available or being designed at that moment.

The CEPT asked manufacturers and operators for technical proposals for GSM. When the basic technology choices had to be made, there were some eight different technical proposals, of which the designs varied widely. Four Franco/German proposals, the outcome of government-subsidised research, were broadband designs. They utilised relatively new technologies (among other things CDMA and/or hybrid designs) and were optimised for high traffic intensities. The four Scandinavian designs, in contrast, were narrowband designs based on TDMA technology. These systems are more optimised for medium to low traffic densities as found in rural areas. Choosing a technology, by the end of 1986, turned into a major conflict. The German and French Governments only wanted to support one of their joint designs, but they did not gain enough support from other country delegations, who judged the most promising Franco-German design "too proprietary".[98] When the selection moved into a deadlock, high-level political intervention in combination with strategic arrangements between manufacturers was necessary to provide sufficient support for the one technology.[99] Ericsson, which supported

93 Just after the adoption of the IPR Policy, ETSI was preparing changes to its Statutes and Rules of Procedure that made it possible to expel members not signing the Undertaking(Tuckett, n. 55 above). Some TNOs made even stronger proposals, resulting in automatic expulsion of non-signing members (CBEMA), *ibid.*

94 See, among others, Tuckett, n. 55 above.

95 ETSI Intellectual Property Rights Policy, as included in the ETSI Rules of Procedure, Annex 6. The term "interim" can be slightly confusing since the original 1993 IPR policy was also an interim policy.

96 XXXV Report on Competition Policy 1995, Commission of the European Communities, Brussels/Luxembourg 1996, pp. 143–145. This report notes that several comments have been received regarding this notification.

97 Cattaneo, n. 78 above.

98 *ibid.*, at 63.

99 The chairman of ETSI's Special Mobile Group, Friedhelm Hillebrand, notes that "back then the heads of state in Germany, France and Britain got personally involved to break the deadlock between CDMA and TDMA [proposals]" (*Communications Week International*, January 19, 1998). For firm strategies, see J.Meurling and R. Jeans, *The mobile phone book: The invention of the mobile telephone industry* (1994).

one of the narrowband designs, went into co-operation with Siemens and included an exchange of technology. Thus the narrowband camp gained significant support from within Germany, making it easier for the German government representatives to come to terms with a choice for a narrowband system. A similar co-operation took place between Ericsson and a French company. After the CEPT agreed on a narrowband design during early 1987, the development of GSM was transferred to the newly established ETSI in 1988, where all the technical details of this standard were laid down during the 1988–1991 period. Several manufacturers already stated from the start that their IPR was available on fair, reasonable and non-discriminatory conditions. This is the "licence with general declaration strategy" as discussed above. When some technology choices had to be made, some IPR owners even declared that they would make their IPRs available at no cost, as Philips did with its IPR on the speech coder that is now being used in GSM.

From 1987 on, the GSM network operators-to-be were organised in the GSM Memorandum of Understanding ("MoU"). By the time that these operators (European PTTs) started their procurement procedures for GSM networks, it was becoming clear that a substantial number of essential IPRs existed on basic GSM technology and that some United States companies held patents that could be most troublesome. Thus licences for building GSM products or operating GSM networks had to be negotiated individually. In particular, the blocking risk when an IPR owner would not agree to license its technology was a nightmare to the parties involved. In a Musketeers' Oath approach, a number of operators decided that they would require the supplier of the network to sign a declaration in which it agreed to serve the whole GSM community—suppliers and operators—on fair, reasonable and non-discriminatory conditions. Most manufacturers agreed to such a statement—although operators had to pay significant amounts to get it. Thus suppliers were lured into the licence with general declaration strategy in order to get purchase orders. However, some manufacturers, particularly Motorola, refused to sign any such arrangement that was not related to individual purchase contracts. With this, Motorola opted to risk losing a number of procurement contracts so as not to have to compromise on licence conditions, in accordance with the licence without general declaration strategy mentioned above.[1]

In relation to competing manufacturers, Motorola chose to demand licence conditions as well: it only allowed for cross-licences and no licences on monetary consideration. During the 1990–1993 time frame, four companies entered into such a cross-licence agreement with Motorola: Siemans, Alcatel, Nokia and Ericsson.[2] Not all of these companies have many or even some essential IPRs for the standard: a recent ETSI statement shows that on the GSM standard, 132 essential IPRs are claimed[3] by their respective owners, of which Motorola (50 per cent of the patents), AT&T (16 per cent), Bull (8 per cent) and Philips (8 per cent) are the largest.[4] But one has to keep in mind that cross-licences can exchange essential IPRs for non-essential IPRs, or even IPRs for a completely different standard! And although the 1993 ETSI Policy and Undertaking, discussed above, did not allow demands for cross-licences, it has been seen that it was annulled a year later. Also following this, some more IPR issues surfaced. In the United States, the developer InterDigital Technology Corporation ("IDC") claimed that its patents were infringed in many TDMA-based mobile telephony systems, including GSM. In April 1995, the United States Federal Court, however, ruled the claims invalid, making mobile telephone manufacturers around the world breathe a sigh of relief.[5] InterDigital had already collected $70 million from royalties. One year later, however, the German Federal Patent Court upheld one of the InterDigital patents that was found invalid in the United States.[6] The strategy of IDC on this 1991 patent illustrates the non-disclosure strategy.

The market for GSM infrastructure is strongly polarised. In Europe, five manufacturers account for 94 per cent of the market for switching infrastructure and 84 per cent for base station products (see Table 3). In financial terms this is a market of considerable size, while analysts expect that total (worldwide) investment in GSM infrastructure by the end of the century will exceed 100 billion US$.[7]

**Table 3: Estimated suppliers' market share of the 33 largest GSM networks in Europe, December 1996, plus worldwide market share of GSM terminals during 1996.[8]**

| Supplier | Score switching | Market share switching | Score base stations | Market share base stations | Market share mobile terminals (worldwide) |
|---|---|---|---|---|---|
| Ericsson | 10,297 | 48% | 7,978 | 37% | 25% |
| Siemens | 4,426 | 21% | 325 | 2% | 9% |
| Nokia | 3,086 | 14% | 4,617 | 22% | 24% |
| Alcatel | 2,228 | 10% | 2,084 | 10% | 6% |

1 Source: interviews. See also Cattaneo, n. 78 above.

2 "Motorola/Nokia: Austauch von GSM-patenten" (1993) 2 *Funkschau*, 50. In addition to the enterprises mentioned in this article, Ericsson signed a cross-licence with Motorola.

3 This list is based on statements by the IPR owners. It does not guarantee that the IPRs listed are actually essential for GSM, neither does it guarantee that no essential IPRs are missing.

4 See n. 15 above.

5 *Electronics Weekly*, April 5, 1995, p. 3.

6 "InterDigital Patent upheld in Germany", a press statement published by InterDigital Communications Corporation, November 18, 1996.

7 Communication from the Commission on strategy and policy orientations with regard to the further development of mobile and wireless communications (UMTS), COM (97) 513, n. 1.

8 Calculations are based on MTA-EMCI data (April 1997) *Mobile Communications International*. Manufacturers are awarded a score for their share in infrastructure supply for all European networks with more than 100,000 subscribers, weighted on actual subscriber numbers. The data used refer to the original order for the GSM network; subsequent expansion orders are not included. If a system is supplied by more than one vendor, the share is equally divided. For some networks, no specification for switching and base stations was available; this has introduced small deviations (such as a market share for Siemens base stations). Terminal data are based on Mike Pinch (April 1997) *Mobile Europe*, 14.

| Supplier | Score switching | Market share switching | Score base stations | Market share base stations | Market share mobile terminals (worldwide) |
|---|---|---|---|---|---|
| Motorola | 140 | 1% | 2,871 | 13% | 20% |
| Lucent | 515 | 2% | 950 | 4% | |
| Matra | 443 | 2% | 664 | 3% | |
| Nortel | 303 | 1% | 0 | 0% | 3% |
| Philips | 0 | 0% | 466 | 2% | |
| Orbitel | 0 | 0% | 400 | 2% | |
| Italtel | 0 | 0% | 1,072 | 5% | |

The same accounts for the GSM handset market. About four years after the commercial introduction of GSM, three suppliers—Nokia, Motorola and Ericsson—have a combined share of more that 80 per cent of the handset market.[9] The absence of many large players on the world market for mobile handsets, notably Japanese companies like NEC and Mitsubishi, is striking.[10] Although they could have underestimated the development of the GSM market, and behaved passively, commentators also argue that these parties were perhaps refused licences on reasonable terms.[11] The recent introduction of Japanese handsets[12] indicates that now these companies have access to the necessary licences, although some are built around existing handset designs or chip sets.

It is clear that both infrastructure and mobile stations' markets are very polarised. Those parties that have gone into cross-licences control no less than 90 per cent of the market. These agreements allow for cheap access to IPRs for those companies that previously invested heavily in R&D to obtain patents. When volumes are very high, the advantages of cross-licensing more than outweigh the costs made on R&D. This could be characterised as a "proprietary club". Companies that did *not* get involved in a cross-licence pay the full licence price and are placed in a strongly unfavourable position for market competition. After all, they have to pay for the full set of licence fees. Even when individual licences are reasonably priced, the cumulative effect of having many IPRs in one standard can drive up the total fee. Unconfirmed sources report U.S.$50 paid for the licence fees needed to produce a GSM terminal.[13] For a product that is sold for an average price of about U.S.$150, the licence fees for non-IPR owners represent the highest single cost in this industry.[14]

On January 29, 1998 the ETSI decided on the basic technology for the successor of GSM, called the Universal Mobile Telecommunications System ("UMTS"). In the battle that preceded this choice, seven industry designs contended for the base of UMTS. The most serious candidates were the "Alpha" W–CDMA design, backed among others by Nokia and Ericsson (who are developing this technology for Japanese operator NTT DoCoMo), and the "Delta" TD–CDMA design that was supported by Alcatel, Siemens and Motorola, among others. Finally, a compromise was reached via a proposal that contains key elements of both designs. Analysts comment that one of the most serious and contentious issues is that of intellectual property rights.[15] This could especially be the case now that the compromise that was reached basically covers *both* proposals, thus adding up IPRs on both types of technology. The ETSI is planning to create a patent pool for this new standard, but for now it is not sure whether all IPR owners (especially non-ETSI members) will agree to participate. To date there has not been much experience using patent pools for standards, though it is being used for the MPEG–2 protocol.[16] It is believed that a United States company Qualcomm owns a fairly large number of essential IPRs to the standard as agreed on. ETSI and Qualcomm have been involved in intense discussion on the relevant property rights, and in June 1998 the fears of many involved were embodied when Qualcomm refused to license its technology for UMTS.[17]

## Discussion and Conclusions

Together with the changes in the telecommunications sector, standardisation has undergone structural alterations. The traditional links between manufacturers and national network operators, and the relationship between those operators and the government, made way for something that is to become a level playing-field, with separated entities and competition. In this light the ETSI was created, allowing for a proper representation of the new order in the sector. In contrast to its predecessor CEPT, it is not solely accessible to network operators but to all parties involved in the sector.[18]

However, such a standardisation body inevitably encounters some old and some relatively new problems. Property rights on (parts of) the standard have proved

9 See Patrick Donegan's editorial in (1995) 25 *Mobile Communications International.*

10 It is noteworthy that Mitsubishi actually was active very early in European analogue equipment based on the NMT standard, and even made offers during the early GSM procurements as well.

11 *ibid.*

12 Panasonic achieved a market share of 6 per cent in 1996 (Pinch, see note 8 above).

13 This amount was mentioned by a manufacturer of GSM terminals that did not wish to confirm this figure or unveil his identity.

14 This is the recent wholesale price of a standard model GSM mobile station, as bought by network operators.

15 *EuroInfoTech*, issue 163, Brussels, January 29, 1998.

16 MPEG-2 is a well known protocol used to compress video and audio signals for transmission or storage. The owners of its essential patents, nine companies and one university, have created a patent pool to create a one-stop-shopping clearing house where applicants can obtain the necessary package of patents (although they do not guarantee that this package includes all licences needed to comply with the standard . . . ).

17 ETSI required Qualcomm to license its technology unconditionally, while Qualcomm insisted in a solution which offers backward compatibility with not only GSM but also their own CDMAOne standard. Only under this condition is Qualcomm prepared to license on "fair, reasonable and equitable" royalty fees, which it characterises as "single-digit percentages". ("Qualcomm holds 3Gen to ransom in CDMA compatibility row", June 2, 1998, at www.totaltele.com).

18 For the sake of completeness, it is noted that the CEPT did already allow for participation of two industry representatives per national administration in the Groupe Spécial Mobile.

to be one of the most problematic issues. It is considered inevitable that committee standards cover existing IPRs, notably patents. For a number of reasons, the importance of patents in such standards is increasing. The interests of the different actors vary widely, and it is a complex task to balance these interests. After encountering a strongly undesirable situation with GSM patents, the ETSI tried to develop some clear guidelines on this issue, but its adopted policy provoked strong resistance. It finally withdrew its policy to preserve consensus among its members. Both earlier and later attempts by other organisations—involved in the GSM standard—to reach agreement concerning essential patents failed.

For several reasons, the GSM case is very relevant. Its market is expected to exceed U.S.$100 billion by the end of the century. This ETSI standard covers a large number of essential patents, and licence fees have become the largest single cost for manufacturers. During the first phase of commercialisation, some IPR owners adopted a very restrictive licence strategy. The GSM case indicates the existence of proprietary clubs, with advantageous access to each other's technology via cross-licensing agreements, and dominating the market for GSM infrastructure and terminals. The pooling of IPRs by companies might have caused this strong polarisation in the market. For the next generation of European mobile standards, IPRs are expected again to become a major issue. In June 1998 it became known that the United States company Qualcomm, owner of a large number of essential IPRs for the European UMTS standard, refused to license its technology.

An intriguing question is whether, and in what cases, an owner of an essential IPR in a European standard can be forced to license others under certain conditions, as the Commission mentioned in the 1992 Communication on IPR and standardisation.[19] Abusive exercise of IPRs by individuals or companies that have a dominant position is subject to competition rules, in particular Article 86 of the Treaty. Furthermore, Article 85 regulates agreements between companies (*i.e.* IPR owners). If abuse is concluded, one (far-reaching) result might be compulsory licensing, on predetermined conditions. At this time, there has been no case law in this field. There are, however, some cases about possible abuse of other types of property rights. In *Volvo v. Veng* the European Court decided that a dominant party's refusal to license does not in itself constitute an abuse.[20] But it recognised that in particular circumstances the outcome could be different. And indeed, in the later *Magill* case the Court formulated three conditions from which it concluded a matter of abuse.[21] And, in turn, concluding abuse can be a reason for compulsory licensing. Also in the case of IBM's System/370 the Commission argued that IBM was abusing its dominant position via IPRs; but this case was finally settled via an agreement between IBM and the Commission, not by the court.[22] Finally, the essential facilities doctrine could be a starting-point to deal with abuse on the part of IPR holders.

Again, there have been no cases to date about abuse of IPRs in formal, European standards. Two very important questions, then, could be: (1) can unreasonable licensing conditions be treated the same as refusals to license; and (2) to what degree should agreements or co-operation between IPR holders be allowed?[23]

One could conceive of several scenarios. With strong and binding obligations to IPR owners, fair and reasonable access to a standard is ensured for all candidates, but there is a risk of the drying up of R&D and possibly the withdrawing of important participants from drawing up a standard. In a scenario with no binding measures, one stimulates innovative behaviour but risks the fair and equal access to all parties to that standard. More complex is the scenario where several standards compete in the market-place, as is the case for the United States PCS networks.[24] Designers of the standard (often the major IPR owners) are likely to adopt strategies that are known from non-telecommunications industry standards.[25] A low licence fee is needed to gain the necessary support from other manufacturers. However, there is no guarantee that this owner will not raise the fees once the standard has reached a dominant market position.

The discussion whether the Commission should be more decisive on the possible misuse of essential IPRs in standards is all the more urgent because the standards in question have an obligatory character. On the other hand, one must consider that those patents often seem from intensive and costly R&D efforts that incorporate significant risks, since much research never leads to any patent. From that point of view, IPR owners should be given exclusive rights as specified in patent law to protect the outcome of their efforts and, more generally, to ensure innovative behaviour among those parties. In addition, the nature of the market itself, the

19 n. 54 above, p. 9.

20 Case 238/87 [1988] E.L.R. 6211. See also Wefers Bettink, "De schaduw van Magill" (1997) 7/8 *Nederlands Tijdschrift voor Europees Recht*, 166.

21 *RTE, ITP & BBC v. Commission*, Case T–69/89, T–70/89 and T–76/89 [1991] E.C.R. II–485 at 535, 575 and the subsequent case *RTE and ITP v. Commission* C–241/91P [1995] I–743. In this case, the question was whether it was unlawful for three Irish television broadcasters to refuse to license programme information to a third party. The court concluded that there was an abuse based on the conditions that (1) there is a refusal to license that (2) prohibits the introduction of a new product to the market for which there is (3) potential demand.

22 The case concerned the interfacing of third-party products to IBM's System/370 mainframe. IBM kept third parties from doing so by claiming IPR and by not making the interface characteristics public. The Commission considered this an abuse of monopoly under Art. 86 of the E.C. Treaty. Finally, the case was settled by IBM agreeing to provide the necessary information (Lea and Shurmer, n. 52 above, at 91). The reader is also referred to the limitations set to property rights by the E.C. Directive 90/250 on the Legal Protection of Computer Programs, which in some circumstances allows for "reverse engineering" or "decompiling".

23 Actually, one could even consider ETSI itself as a patent pool (Good, n. 47 above, at 296).

24 A PCS network operator is free to choose its technology. A number of systems are ex-post standardised in Telecommunications Industry Association ("TIA"). Most successful are IS-95 CDMA (backed by Qualcomm, Motorola, Lucent and others), PCS-1900 (derived from the European GSM and DCS-1800 standards) and D-AMPS (backed mainly by Ericsson).

25 Think of VCR cassette formats, compact discs, etc.

necessary knowledge and the financial risks could also be a reason that only a small number of competitors are active. And, lastly, a large set of individually reasonably priced fees can amount to a sum that is an unbridgeable threshold for non-owners of IPRs (the cumulative effect). Thus there is no single best way to balance the interest of the parties involved such that public interest is served best, and the tension between IPRs and standards can be expected to be one of the most delicate issues for future standards as well.